DRAFT **July 2009**

Risk Assessment Model -- Calculation of Potential Risks from Consumption of Human Milk

Chemical	Conc in Fish Cf (mg/kg)	Slope Factor SFo (mg/kg/day)-1	Intermediate MRL (mg/kg/day)	Chronic RfD (mg/kg/day)	Half-life h (days)	Mother ADDm (mg/kg/day)	Milk Cmf (mg/kg-lipid)	Fraction of human milk that is fat	Infant ADDca-i (mg/kg/day)	Infant ADDnc-i (mg/kg/day)	Infant/Mother Exposure Ratio	Excess Lifetime Cancer Risk Mother ELCRm	Excess Lifetime Cancer Risk Infant ELCRi	Infant/Mother Risk Ratio	Hazard Quotient Mother HQm	Hazard Quotient Infant HQi	Infant/Mother Risk Ratio
Total PCBs	1	2	0.00003	0.00002	2555	0.000281	3.11	0.04	0.00010	0.0135	48	2.4E-04	1.9E-04	0.80	14	449	32
PCB 153	1	2	0.00003	0.00002	1387	0.000281	1.69	0.04	0.00005	0.0073	26	2.4E-04	1.0E-04	0.43	14	244	17
PCB 153	1	2	0.00003	0.00002	1387	0.000281	1.69	0.08	0.00010	0.0146	52	2.4E-04	2.1E-04	0.87	14	488	35
PCB 153	1	2	0.00003	0.00002	10038	0.000281	6.11	0.04	0.00019	0.0264	94	2.4E-04	3.8E-04	1.6	14	881	63
PCB 153	1	2	0.00003	0.00002	10038	0.000281	6.11	0.08	0.00038	0.0528	188	2.4E-04	7.5E-04	3.1	14	1761	125

Notes:

Acceptable levels are ELCR = 1E-6 and HQ = 1

Equations

ADDm = (Cf x Irf x Conv2 x Ff) / BWm

ADDca-i = (Cmf x IRMadj x f3 x f4 xf5 x Edi x Efi) / (Ati)

ELCRm = ADDm x Sfo x 30 / 70 ELCRm adjusted to 30-year exposure

ELCRi = ADDca-i x Sfo

Cmf = (ADDm x h x f1) / (ln2 x f2) for 7 year halflife

Cmf = (ADDm x h x f1)*0.5 / (ln2 x f2) for 27.5 year halflife

ADDnc-i = (Cmf x IRMadj x f3 x f4 x f5)

HQm = ADDm / RfD

HQi = ADDnc-i / MRL

Default Values

Cf	chemical specific	mg/kg	Concentration of chemical in fish
Irf	18	g/day	Mother's ingestion rate of fish
Conv	0.001	kg/g	Conversion factor
Ff	1	fraction	Fraction of fish contaminated
BWm	64	kg	Body weight of mother
h	chemical specific	days	Half-life of chemical in body
Fone	0.9	fraction	Fraction of ingested chemical stored in fat
Ftwo	0.3	fraction	Fraction of mother's weight that is fat
IRMadj	0.15	kg/kg/day	Infant's ingestion rate of milk (averaged over exposure duration)
Fthree	0.04	fraction	Fraction of human milk that is fat
Ffour	0.9	fraction	Fraction of ingested chemical that is absorbed
Ffive	calculated	fraction	Fraction of initial chem conc present during year
Edi	0.5	year	Exposure duration of breast-feeding infant
Efi	365	days/year	Exposure frequency of breast-feeding infant
Atc	25550	days	Averaging time - carcinogens (70 years)
Sfo	chemical specific	(mg/kg/day)-1	Slope Factor - oral
RfD	chemical specific	mg/kg/day	Reference Dose - oral
Conv2	1.00E-06	kg/mg	Conversion factor 2

Calculated Values

ADDm	mg/kg/day	Average Daily Dose to mother
Cmf	mg/kg-lipid	Chemical concentration in milkfat
ADDca-i	mg/kg/day	Average Daily Dose to breast-feeding infant, cancer
ADDnc-i	mg/kg/day	Average Daily Dose to breast-feeding infant, non-cancer
ELCRm	risk	Excess Lifetime Cancer Risk to mother
ELCRi	risk	Excess Lifetime Cancer Risk to infant
HQm	quotient	Hazard Quotient to mother
HQi	quotient	Hazard Quotient to infant

Calculation of F5 (see Attachment 2 to Appendix C of draft DEQ Human Health Risk Assessment Guidance)

k	calculated	(days)-1	rate constant for chemical loss in body = ln(2)/h
b	0.9	kg/day	daily secretion of milk
c	calculated	fraction	fraction of chemical lost in human milk per day
hb	calculated	days	maternal half-life for breastfeeding
kb	calculated	(days)-1	rate constant for chemical loss by breast feeding = ln(2)/hb
			kb = k + c = k + b x f1 x f3 / (BWm x f2)
b'0	150	ml/kg/day	mean milk intake rate 0 to 3 months
b'91	140	ml/kg/day	mean milk intake rate 3 to 6 months
b'183	110	ml/kg/day	mean milk intake rate 6 to 9 months
	83	ml/kg/day	mean milk intake rate 9 to 12 months

Half-life h (days)	k	kb	Cmilkfat91 / Cmilkfat0	Cmilkfat183 / Cmilkfat0	b'91 / b'0	b'183 / b'0	Six months of exposure f5	One year of exposure f5
1387	0.000500	0.00219	0.86	0.75	0.93	0.73	0.80	0.55
2555	0.000271	0.00196	0.86	0.74	0.93	0.73	0.80	0.54
10038	0.000069	0.00176	0.86	0.74	0.93	0.73	0.80	0.54